

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

August 11, 2006

Board of Land
and Natural Resources
Honolulu, Hawaii

REQUEST FOR AUTHORIZATION TO ISSUE TWO
NORTHWESTERN HAWAIIAN ISLANDS (NWHI)
RESEARCH, MONITORING AND EDUCATION PERMITS:
1) ONE TO DR. CARL MEYER OF THE HAWAII INSTITUTE OF MARINE BIOLOGY
FOR THE MONITORING AND SERVICE OF PREVIOUSLY DEPLOYED DEVICES
AND DEPLOYMENT OF ADDITIONAL ACOUSTIC RECEIVERS, AND
2) ANOTHER TO MR. PAUL MURAKAWA OF THE DIVISION OF AQUATIC
RESOURCES FOR ACTIVITIES UNDER THE NWHI ULUA FISH TAGGING PROJECT.
BOTH VALID FROM LATE AUGUST THROUGH LATE SEPTEMBER 2006
IN STATE WATERS OF THE NWHI STATE MARINE REFUGE

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization to issue two NWHI Access and Activity Permits to Applicants 1) Dr. Carl Meyer of the Hawaii Institute of Marine Biology, and 2) Paul Murakawa of the Division of Aquatic Resources. The Research, Monitoring and Education Permits, as described below, will allow activities to occur in the NWHI State Marine Refuge (0-3 miles) waters surrounding the following areas:

- Nihoa Island
- Necker Island (Mokumanamana),
- French Frigate Shoals,
- Laysan Island,
- Maro Reef,
- Gardner Pinnacles,
- Lisianski Island and Neva Shoal,
- Pearl and Hermes Atoll, and
- Kure Atoll State Wildlife Refuge.

The activities covered under this permit will occur from late August 2006 through late September 2006, from the support vessel NOAA Ship Hi'ialakai.

INTENDED ACTIVITIES:

Dr. Carl Meyer's Application:

The general purpose of Dr. Meyer's proposed activities is to determine how widely top predators range in the Northwestern Hawaiian Islands, and whether their movements are predictable. Top predators play a keystone role in the Northwestern Hawaiian Islands ecosystem. In the NWHI, this role is filled by sharks and large teleost fishes. Empirical data on top predator movements will be valuable for developing appropriate management strategies for these ecologically important animals.

The researchers propose to answer three questions relevant to management zoning: (1) Do top predators move across open ocean between atolls? (2) How extensive are their intra-atoll movements? and (3) Do top predators exhibit predictable patterns of movement and habitat use? These questions are directly pertinent to management of NWHI resources.

The DAR staff finds that the proposed activities are consistent with and support the purposes of the Refuge, primarily to better understand and manage the resources within the marine refuge.

- a) Deployment of underwater receivers at Nihoa and Gardner Pinnacles: Meyer et al. will create two temporary receiver moorings to record the presence of acoustic transmitters implanted in top predators. They will create these moorings in areas of soft sediment and inert substrate, avoiding live corals. These moorings have been tested and proven to withstand high surf. The moorings will be removed when monitoring has been completed. Underwater receivers will be anchored to the moorings and will record the presence of any acoustic tag within 500m.
- b) Deployment of transmitters: Meyer et al. will tag four species of top predator with acoustic and satellite transmitters. The species of interest are *Galeocerdo cuvier*, tiger shark; *Carcharhinus amblyrhynchos*, gray reef shark; *Triaenodon obesus*, whitetip reef shark, and *Aprion virescens*, grey snapper. They will collect sharks and snapper by trolling with artificial lures, handlining with a single baited hook, or via bottom set 6 hook line for large sharks. Acoustic transmitters are surgically implanted through a small incision which is then sutured closed. Satellite transmitters are attached via small bolts through the dorsal fin, or via titanium-steel darts inserted under the skin at the base of the dorsal fin. After transmitters are attached, the animal is released, and the entire process takes less than 10 minutes. Meyer et al. propose to tag 10 tiger sharks (at Nihoa and FFS), 7 gray reef sharks (at Nihoa and FFS), 10 whitetip reef sharks at FFS, and 10 grey snapper at Nihoa.
- c) Data retrieval, reduction, and analysis: Meyer et al will retrieve and download data from 5 underwater receivers already in place at French Frigate Shoals.

On this cruise, Dr. Meyer will collect data from the monitoring devices deployed earlier this year on a previous cruise trip under a permit (DLNR.NWHI06R003) issued by the Board on April 28, 2006. He will also service and repair the same devices as necessary and install additional acoustic receivers for certain areas that have not been covered previously. This proposed cruise is a necessary and logical extension of the research activities that have been performed earlier.

Dr. Meyer will not conduct any taking, killing or collecting activities of any kind of specimens or organisms during this cruise. There will be no active interactions with any marine lives either.

Paul Murakawa's Application:

The purpose of Mr. Murakawa's project is to help determine the migration patterns and genetic signature of jacks, specifically the giant and blue trevallies in the Northwestern Hawaiian Islands. Data collected from the tagged fish could determine if the population of jacks in the Northwestern Hawaiian Islands are unique genetically and determine migration patterns which may be useful for management in the Refuge. A different management style may be used if the population of jacks in the NWHI is determined to be different than the MHI.

Currently, the DAR ulua tagging project is active mostly in the Main Hawaiian Islands, with a few fish tagged in the NWHI by commercial fishermen and a few years ago by recreational fishermen on Midway.

It is uncertain that the jacks in the NWHI are different genetically from those in the MHI or if they migrate the vast distance between the NWHI and the MHI. With the proposed project in the NWHI, DNA analysis and external dart tags may help DAR determine if either case is true.

On this proposed cruise, fish at different sites will be caught with handlines, brought aboard the vessel where it will be tagged with an external dart tag. A small portion (the size of a hole punch) of the soft dorsal will be clipped off and preserved in ethyl alcohol for future genetic analysis. Fish will be measured (fork length) and then released.

The DAR staff finds that the NWHI Fish Tagging Project is consistent with and supports the purposes of the Refuge, primarily to better understand and manage the resources within the marine refuge.

REVIEW PROCESS:

These two permit applications have not been sent out for scientific or cultural review and comments for the following reasons: 1) the applications were received too late to have this review undertaken and 2) in the case of the Meyer application, this work was previously reviewed and approved and the activity proposed herein is an extension of his previous research.

APPLICANT RESPONSE:

No responses from the Applicants are required.

STAFF OPINION:

Allow the activities described under both permits to progress as detailed above.

Ensure that all acoustic receivers installed for the pelagic fish tracking are noted by GPS and that care will be taken to not place the receivers in sensitive coral habitat.

Ensure that all the giant and blue trevallies tagged are documented to include date, tag no. species type, fork length, time and GPS location.

RECOMMENDATION:

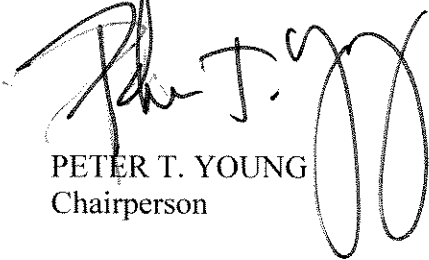
“That the Board authorize to issue, with stated conditions, two NWHI Research, Monitoring and Education Permits to 1) Dr. Carl Meyer of the Hawaii Institute of Marine Biology, and 2) Paul Murakawa of the Division of Aquatic Resources, for their access and certain activities within the designated State waters of the NWHI State Marine Refuge.”

Respectfully submitted,



DAN POLHEMUS
Administrator

APPROVED FOR SUBMITTAL



PETER T. YOUNG
Chairperson

APPENDIX 1

**State of Hawai'i
DLNR
Northwestern Hawaiian Islands State Marine
Refuge
Permit Application Form**

<i>For Office Use Only</i>
Permit No:
Expiration date:
Date Appl. Received:
Appl. Fee received:
NWHI Permit Review Committee date:
Board Hearing date:
Post to web date:

Type of Permit

- ☒ I am applying for a **Research, Monitoring & Education** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☒ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a permit for a **Native Hawaiian** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a **Special Activity** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.

Briefly describe **Special permit** activity:

When will the NWHI activity take place?

- ☐ **Summer** (May-July of _____ (year)
Note: Permit request must be received before February 1st
Specific dates of expedition _____
- ☒ **Fall** (August-November) of **2006** (year)
Note: Permit request must be received before May 1st
Specific dates of expedition **Aug 25 - Sept 28**


☐ **Other**

NOTE: INCOMPLETE APPLICATIONS WILL NOT BE ACCEPTED

Please Send Permit Applications to:

NWHI State Marine Refuge Permit Coordinator
State of Hawai'i
Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai'i 96813

NWHI State Marine Refuge Permit Application
See Appendix 2 for Application Instructions

Section A – Applicant Information	
1. Project Leader (attach Project Leader's CV or resume) <input checked="" type="checkbox"/> CV attached Meyer, Carl, G. Name: Last, First, Middle Initial	Assistant Researcher Title
2. Mailing Address (Street/PO Box, City, State, Zip) PO Box 1346, Kaneohe, Hawaii, 96744	Telephone (808) 236-7477 Fax (808) 236-7443 Email Address carlm@hawaii.edu
3. Affiliation (Institution/Agency/Organization) Hawaii Institute of Marine Biology, University of Hawaii	For graduate students, Major Professor 's Name & Telephone
4. Sub-Permittee/Assistant Names, Affiliations, and Contact Information <input checked="" type="checkbox"/> CV or resume attached Yannis Papastamatiou, Zoology Department, University of Hawaii	
5. Project Title Movements of Top Predators along the Hawaiian Archipelago	
6. Applicant Signature 	7. Date (mm/dd/yyyy) 07/11/2006

Section B: Project Information
8. (a) Project Location <input checked="" type="checkbox"/> NWHI State Marine Refuge (0-3 miles) waters surrounding: <input checked="" type="checkbox"/> Nihoa Island <input checked="" type="checkbox"/> Necker Island (Mokumanamana) <input checked="" type="checkbox"/> French Frigate Shoals <input checked="" type="checkbox"/> Laysan <input checked="" type="checkbox"/> Maro <input checked="" type="checkbox"/> Gardner Pinnacles <input checked="" type="checkbox"/> Lisianski Island, Neva Shoal <input checked="" type="checkbox"/> Pearl and Hermes Atoll <input checked="" type="checkbox"/> Kure Atoll, State Wildlife Refuge <input type="checkbox"/> Other NWHI location Describe project location (include names, GPS coordinates, habitats, depths and attach maps, etc. as appropriate). Please refer to Appendix 1

(b) check all actions to be authorized:

☒ Enter the NWHI Marine Refuge waters

☐ Take (harvest) ☐ Possess ☐ Transport (☐ Inter-island ☐ Out-of-state)

☐ Catch ☐ Kill ☐ Disturb ☐ Observe

☐ Anchor ☐ Land (go ashore) ☐ Archaeological research

☐ Interactions with Sea Turtles or Monk Seals ☐ Interactions with Seabirds

☐ Interactions with Live Coral, Ark Shells or Pearl Oysters

☐ Interactions with Jacks, Grouper or Sharks

☐ Conduct Native Hawaiian religious and/or cultural activities

☒ Other activities Service underwater receivers, deploy additional receivers

(c) Collection of specimens – collecting activities (would apply to any activity):

Organisms or objects (List of species, if applicable, add additional sheets if necessary):

Common name	Scientific name	No. & size of specimens	Collection Location(s)
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No collections

(d) What will be done with the specimens after the project has ended?

No collections

(e) Will the organisms be kept alive after collection? ☐ yes ☐ no

Specific site/location _____

Is it an open or closed system? ☐ open ☐ closed

Is there an outfall? ☐ yes ☐ no

Will these organisms be housed with other organisms? If so, what are the other organisms?

No collections

(Please attach additional documentation as needed to complete the questions listed below)

<p>9. Purpose/Need/Scope:</p> <p>State purpose of proposed activities:</p> <p>Please see appendix 1</p>
<p>Describe how your proposed activities will help provide information or resources to fulfill the State Marine Refuge purpose and to reach the Refuge goals and objectives.</p> <p>Please see appendix 1</p> <p>Give reasons why this activity must take place in the NWHI and cannot take place in the Main Hawaiian Islands, or elsewhere.</p> <p>Please see appendix 1</p>
<p>Describe context of this activity, include history of the science for these questions and background.</p> <p>Please see appendix 1</p>
<p>Explain the need for this activity and how it will help to enhance survival or recovery of refuge wildlife and habitats.</p> <p>Please see appendix 1</p>
<p>Describe how your proposed project can help to better manage the State Marine Refuge.</p> <p>Please see appendix 1</p>
<p>10. Procedures (include equipment/materials)</p> <p>Please see appendix 1</p>
<p>11. Funding sources (attach copies budget & funding sources).</p> <p>Please see appendix 1</p>
<p>12. List all literature cited in this application as well as all other publications relevant to the proposed project.</p> <p>Please see appendix 1</p>
<p>13. What types of insurance do you have in place? (attach documentation)</p> <p><input type="checkbox"/> Wreck Removal Please see appendix 1</p> <p><input type="checkbox"/> Pollution</p>
<p>14. What certifications/inspections do you have scheduled for your vessel? (attach documentation)</p> <p><input type="checkbox"/> Rat free <input type="checkbox"/> tender vessel <input type="checkbox"/> gear/equipment</p> <p><input type="checkbox"/> Hull inspection <input type="checkbox"/> ballast water Please see appendix 1</p>
<p>15. Other permits (list and attach documentation of all other required Federal or State permits).</p> <p>Please see appendix 1</p>
<p>16. Project's relationship to other research projects within the NWHI State Marine Refuge, National Wildlife Refuge, NWHI Coral Reef Ecosystem Reserve, or elsewhere.</p> <p>Please see appendix 1</p>

Section C: Logistics	
17. Time Frame:	
Project Start Date <div style="text-align: center; font-weight: bold;">May 2005</div>	Project Completion Date <div style="text-align: center; font-weight: bold;">Sept 2007</div>
Dates actively inside the State Marine Refuge. August 26 - September 27, 2006	
Personnel schedule in the State Marine Refuge (describe who will be where and when). Carl Meyer & Yannis Papastamatiou will be in the SMR during the above dates.	
18. Gear and Materials	
<input checked="" type="checkbox"/> Dive equipment <input type="checkbox"/> Radio Isotopes <input type="checkbox"/> Collecting Equipment <input type="checkbox"/> Chemicals (specify types)	
19. Fixed installations and instrumentation.	
<input type="checkbox"/> Transect markers <input checked="" type="checkbox"/> Acoustic receivers <input type="checkbox"/> Other (specify)	
20. Provide a time line for sample analysis, data analysis, write-up and publication of information. See appendix 1	
21. Vessel Information:	
Vessel Name NOAA Ship HI'IALAKAI IMO Number 8835619 Vessel Owner NOAA Flag USA Captain's Name CDR Scott Kuester Chief Scientist or Project Leader Peter Vroom Vessel Type Oceanographic Research Call sign WTEY Length 224 feet Gross tonnage 1,914 Port of Embarkation Honolulu Last port vessel will have been at prior to this embarkation Honolulu Total Ballast Water Capacity: Volume 487 m3 Total number of tanks on ship 10 Total Fuel Capacity: 228,642 U.S. gal. Total number of fuel tanks on ship 15 Other fuel/chemicals to be carried on board and amounts: gasoline - up to 700 U.S. gal.; lube oil - up to 10,442 U.S. gal.; numerous other industrial and household chemicals used to operate a 224-foot research vessel Number of tenders/skiffs aboard and specific type of motors: See appendix 2 Does the vessel have the capability to hold sewage and grey-water? Describe in detail. See appendix 2 Does the vessel have a night-time light protocol for use in the NWHI? Describe in detail (attach additional pages as necessary) See appendix 2	
On what workboats (tenders) will personnel, gear and materials be transported within the State Marine Refuge? See appendix 2	
How will personnel, gear and materials be transported between ship and shore? See appendix 2	
If applicable, how will personnel be transported between islands within any one atoll? See appendix 2	

APPENDIX 1

(8a) Project Location:

I would like to service underwater acoustic receivers currently deployed at the following NWHI locations;

Table 1.

Atoll	Location	Latitude	Longitude	Depth (ft)
Nihoa	West Side	23.061	-161.931	55
Necker	West Side	23.577	-164.705	50
FFS	Rapture Reef	23.635	-166.186	85
FFS	La Perouse	23.769	-166.262	30
FFS	East Island	23.787	-166.207	10
FFS	Tern Island	23.867	-166.288	15
FFS	Trig Island	23.869	-166.242	10
FFS	Trig Island	23.869	-166.242	10
Maro	South End	25.378	-170.567	20
Maro	North Tip	25.458	-170.671	55
P&H	SW Corner	27.753	-175.948	50
P&H	SE Channel	27.787	-175.836	30
P&H	Main Channel	27.791	-175.863	35
P&H	NW Side	27.910	-175.909	50
Midway	Frigate Point	28.191	-177.395	30
Midway	Fish Hole	28.197	-177.363	40
Midway	North Flats	28.277	-177.372	8
Kure	West Channel	28.389	-178.360	45
Kure	West Channel	28.404	-178.375	40
Kure	North Flats	28.452	-178.315	12

I would like to install new receivers at the following NWHI locations;

Table 2.

Atoll	Location	Latitude	Longitude	Depth (ft)
Gardner Pin.	W. of Main Pinnacle	24.999	-168.000	60
Laysan	S. Laysan Island	25.754	-171.734	60
Laysan	W. Laysan Island	25.773	-171.745	10
Lisianski	South Lisianski	25.943	-173.885	45
Lisianski	E. Lisianski Island	26.067	-173.960	10

(9) Purpose/Need/Scope:

The purpose of our proposed activities is to determine how widely top predators range in the Northwestern Hawaiian Islands, and whether their movements are predictable. We are testing the following null hypotheses;

H1: Top predators do not move across open ocean between NWHI atolls

H2: Top predators are not wide-ranging within individual atolls

H3: Top predators do not exhibit predictable patterns of movement and habitat use

Describe how your proposed activities will help provide information or resources to fulfill the State Marine Refuge purpose and to reach the Refuge goals and objectives:

We will provide empirical data on top predator movements that will be valuable for developing appropriate management strategies for these ecologically important animals.

Give reasons why this activity must take place in the NWHI and cannot take place in the Main Hawaiian Islands, or elsewhere.

The questions that we are addressing are directly pertinent to management of NWHI resources (this component of our study involves quantifying movements of top predators captured within the NWHI), hence the study must be carried out in the NWHI. It would not be feasible to conduct this component of our study outside the NWHI.

Describe context of this activity, include history of the science for these questions and background.

Top predators play a keystone role in many ecosystems and in the Northwestern Hawaiian Islands (NWHI) this role is filled by sharks (primarily *Galeocerdo cuvier*, *Carcharhinus galapagensis*, *Carcharhinus amblyrhynchos* and *Triaenodon obsesus*) and large teleost fishes (primarily *Caranx ignobilis*) (DeCrosta 1981, Wetherbee et al. 1997, Friedlander & DeMartini 2002, DeMartini et al. 2005). Previous NWHI studies have quantified top predator age and growth (Parrish et al. 1980, DeCrosta 1981, Sudekum et al. 1991), reproduction (Parrish et al. 1980, Sudekum et al. 1991, Wetherbee et al. 1997), diet and trophic interactions (Sudekum et al. 1991, Wetherbee et al. 1997), and spatial distribution and abundance (Wetherbee et al. 1997, Friedlander & DeMartini 2002, DeMartini et al. 2005). The movement patterns of top predators in the NWHI have received far less attention with previous scientific studies limited to short-term (<48h) acoustic tracks of 3 *G. cuvier* at French Frigate Shoals (Tricas 1981, Lowe et al. in press) and longer term acoustic monitoring of tiger sharks (N=14), *C. galapagensis* (N=10) and *C. ignobilis* (N=3) at French Frigate Shoals and Midway.

We are currently quantifying the movements of ecologically important top predators in the NWHI, and addressing 3 questions relevant to management zoning; (1) Do top predators move across open ocean between atolls?, (2) How extensive are their intra-atoll movements?, and (3) Do top predators exhibit predictable patterns of movement and habitat use? In 2005 we equipped 107 top predators (6 species) with surgically-implanted acoustic transmitters and monitored their subsequent movements using 18 underwater receivers stationed on the seabed at 5 atolls in the NWHI. Using this system we obtained the first empirical evidence that gray reef sharks (*Carcharhinus amblyrhynchos*) move across open ocean between atolls (Meyer et al. submitted¹), and found that all 6 top predator species investigated were wide-ranging within individual atolls. We also found that several species exhibited predictable patterns of movement, including diel habitat shifts and lunar rhythmicity (Meyer et al. submitted²). We used this technology to identify an important ulua (*C. ignobilis*) spawning site on the south side of FFS atoll. We propose to continue this research in order to provide additional empirical fish movement data that will assist NWHI resource managers to assess the potential impact of different management strategies.

Explain the need for this activity and how it will help to enhance survival or recovery of refuge wildlife and habitats.

We need to know how far coral reef top predators range over months or years in order to design refuges that contain appropriate habitat types and are large enough to provide effective, long-term protection for these animals. Despite this basic design requirement and the burgeoning popularity of 'no fishing' Marine Protected Areas (MPAs) as coral reef management tools, empirical data quantifying long-term movement patterns and space requirements of coral reef fishes & sharks

remain scarce (Roberts & Polunin 1993; Nowlis & Roberts 1999; Kramer & Chapman 1999; Sadovy et al. 2003; Gerber et al. 2005; Meyer & Holland 2005). We will provide empirical top predator movement data that will enable resource managers to optimize conservation strategies for these animals. A good example of this is our recent discovery that an adult female gray reef shark swam 266 km from Kure Atoll to Pearl & Hermes Reef (crossing several management jurisdictions). This is the first time that a gray reef shark has been empirically shown to cross open-ocean and the scale of this journey has significant implications for management of these sharks which are being increasingly targeted by the lucrative shark fin trade (Raloff 2002).

Describe how your proposed project can help to better manage the State Marine Refuge.

We are addressing questions that are directly relevant to the design of effective Marine Protected Areas (a cornerstone of the ecosystem approach to management). The NWHI provide an ideal opportunity to quantify long-term movement patterns and space utilization of coral reef top predators in a largely unexploited environment, and to evaluate the minimum MPA size required for effective long-term protection of these large animals. Our research in the NWHI is providing empirical data that are valuable for State Marine Refuge management and that can also be used to evaluate management strategies for coral reef top predators in other, populated areas where large MPAs are not feasible because of social resistance (Meyer et al. submitted¹).

(10) Procedures (include equipment/materials)

(a) Deployment of underwater receivers

We will create temporary receiver moorings at the sites described in Table 2 (Section 8 above) using a system that has previously been empirically demonstrated to successfully withstand seasonal high surf. Moorings will consist of sand screws in areas of soft sediment, and chain around inert substrate in hard bottom areas (live substrates will be avoided). We will remove these moorings when acoustic monitoring is completed (receivers will be in place for at least 2 years). The receivers will be anchored to the moorings and suspended 1-2 m above the ocean floor. The receivers will identify and record the presence of any acoustic transmitters within range (up to 500 m). The transmitter number, time of arrival and departure and the date will be recorded and stored until the data are downloaded from the receivers to a computer. The receivers have a battery life of approximately 15 months and will be serviced at 6 to 12 month intervals.

(b) Data retrieval, reduction and analysis.

We will download receivers currently deployed at NWHI locations (Table 1) during the September 2006 cruise. Data downloading consists of interfacing the receiver to a computer via a magnetically coupled probe and the serial port of the computer, and can be accomplished in the field. Preliminary data reduction and analyses will commence onboard the ship after downloading.

(11) Funding sources (attach copies budget & funding sources).

This research is funded by an award from the National Marine Sanctuaries Program (NMSP MOA 2005-008/66882).

(12) List all literature cited in this application as well as all other publications relevant to the proposed project.

DeCrosta MA (1981). Age determination and growth of three species of shallow-water carcharhinid sharks in Hawaii. *Pacific Science* 35:266-267.

DeMartini EE, Friedlander AM and SR Holzwarth (2005). Size at sex change in protogynous labroids, prey body size distributions, and apex predator densities at NW Hawaiian atolls. *Marine Ecology Progress Series* 297: 259–271.

Friedlander AM and EE DeMartini (2002). Contrasts in density, size, and biomass of reef fishes between the northwestern and the main Hawaiian islands: the effects of fishing down apex predators. *Marine Ecology Progress Series* 230:253-264.

Gerber LR, Heppell SS, Ballantyne F, and E Sala (2005). The role of dispersal and demography in determining the efficacy of marine reserves. *Canadian Journal of Fisheries and Aquatic Sciences* 62:863-871.

Holland KN, Lowe CG and BM Wetherbee (1996). Movements and dispersal patterns of blue trevally (*Caranx melampygus*) in a fisheries conservation zone. *Fisheries Research* 25: 279-292.

Holland, KN, AC Bush, CG Meyer, SM Kajiura, BM Wetherbee & CG Lowe (2001). Five tags applied to a single species in a single location: the tiger shark experience. pp. 237-247 in JR Sibert & JL Nielsen, eds. *Electronic tagging and tracking in marine fisheries*. Kluwer Academic Publishers, The Netherlands.

Kramer DL & MR Chapman (1999). Implications of fish home range size and relocation for marine reserve function. *Environmental Biology of Fishes* 55:65-79.

Lowe CG, Wetherbee BM, Crow GL & AL Tester (1996) Ontogenetic dietary shifts and feeding behavior of the tiger shark, *Galeocerdo cuvier*, in Hawaiian waters. *Environmental Biology of Fishes* 47:203-211.

Lowe CG, Wetherbee BM & CG Meyer (In Press). Using acoustic telemetry monitoring techniques to quantify movement patterns and site fidelity of sharks and giant trevally around French Frigate Shoals and Midway Atoll. *Atoll Research Bulletin*.

Meyer CG and KN Holland. (2005). The role of movement patterns, home range size and site fidelity in greater abundance and size of bluespine unicornfish (*Naso unicornis*; Acanthuridae) in a small marine reserve. *Environmental Biology of Fishes* 134:602-606.

Meyer, CG & R Honebrink. 2005. Retention of surgically implanted transmitters by bluefin trevally (*Caranx melampygus*). Implications for long-term movement studies. *Transactions of the American Fisheries Society*. 134:602-606.

Meyer CG, Papastamatiou YP & KN Holland (Submitted¹). Ocean journey by a grey reef shark (*Carcharhinus amblyrhynchos*). *Biology Letters*.

Meyer CG, Holland KN & YP Papastamatiou (Submitted²). Can small Marine Protected Areas protect coral reef top predators? Empirical data from giant trevally (*Caranx ignobilis*) at remote Hawaiian atolls. *Conservation Biology*.

Nowlis JS and CM Roberts (1999). Fisheries benefits and optimal design of marine reserves. *Fishery Bulletin* 97:604-616.

Parrish J, Taylor L, DeCrosta M, Feldkamp S, Sanderson L and C Sorden (1980). Symposium on Status of Resource Investigations in the Northwestern Hawaiian Islands. pp. 175-188.

Raloff J (2002). Clipping the Fin Trade. Science News 162: 232

Randall JE (1977). Contribution to the biology of the whitetip reef shark (*Triaenodon obesus*). Pacific Science 31:143-164.

Roberts CM and NVC Polunin. (1993). Marine reserves: Simple solutions to managing complex fisheries? Ambio 22:363-368.

Sadovy Y, Kulbicki M, Labrosse P, Letourneur Y, Lokani P, and TJ Donaldson (2003). The Humphead Wrasse, *Cheilinus undulatus*: Synopsis of a Threatened and Poorly Known Giant Coral Reef Fish. Reviews in Fish Biology and Fisheries 13:327-364.

Sudekum AE, Parrish JD, Radtke RL and S Ralston (1991). Life history and ecology of large jacks in undisturbed, shallow, oceanic communities. Fishery Bulletin 89: 493-513.

Tricas TC, Taylor LR and G Naftel. (1981). Diel behavior of the tiger shark, *Galeocerdo cuvier*, at French Frigate Shoals, Hawaiian Islands. Copeia 1981:904-908.

Wetherbee BM, Crow GL and CG Lowe. (1996). The biology of the Galapagos shark, *Carcharhinus galapagensis*, in Hawaii. Environmental Biology of Fishes. 45:299-310.

Wetherbee BM, Crow GL and CG Lowe (1997). Distribution, reproduction and diet of the gray reef shark *Carcharhinus amblyrhynchos* in Hawaii. Marine Ecology Progress Series 151: 181-189.

Wetherbee, BM, KN Holland, CG Meyer and CG Lowe. (2004). Use of a marine reserve in Hawaii by the giant trevally, *Caranx ignobilis*. Fisheries Research 67:253-263.

(13) What types of insurance do you have in place? (attach documentation)

NOAA Ship HI'IALAKAI is a U.S. Government-owned and -operated research vessel and is self-insured by the U.S. Government.

(14) What certifications/inspections do you have scheduled for your vessel? (attach documentation).

- Rat Free (scheduled with U.S. Dept. of Health and Human Services for April 2006)
- Hull Inspection (scheduled with Hawaii Institute of Marine Biology biologists (normally Scott Godwin) prior to projects working in the Northwestern Hawaiian Islands (NWHI)) to ensure no nuisance algae or other fouling species are transported to the NWHI.
- Ballast water information is transmitted to USCG as required by CFR Title 33, Vol. 2, Parts 151.1500 to 199; IMO Resolution A.868(20); and USCG COMDTPUB P16700.4

(15) Other permits (list and attach documentation of all other required Federal or State permits).

US-FWS & NWHI-CRER permits pending

(16) Project's relationship to other research projects within the NWHI State Marine Refuge, National Wildlife Refuge, NWHI Coral Reef Ecosystem Reserve, or elsewhere.

We are also quantifying movements of sharks and reef fishes in the Main Hawaiian Islands using the same technologies, and have an archipelago wide array of listening stations (Kure Atoll to Kona, Hawaii).

(20) Provide a time line for sample analysis, data analysis, write-up and publication of information.

Analyses & interpretation of data are ongoing. We have already submitted 2 manuscripts describing our 2005 findings to international peer reviewed journals, and presented our data at a recent international ocean science conference.

APPENDIX 2

(21) Vessel Information:

Vessel Name – NOAA Ship HI'IALAKAI

IMO Number – 8835619

Vessel Owner – U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration (NOAA)

Flag – USA

Captain's Name – CDR Scott Kuester, NOAA

Chief Scientist or Project Leader – Peter Vroom, Ph.D., NOAA

Vessel Type – Oceanographic Research

Call Sign – WTEY

Length – 224 feet

Gross Tonnage – 1,914

Port of Embarkation – Honolulu

Last port vessel will have been at prior to this embarkation – Honolulu

Total Ballast Water Capacity:

Volume – 487 m³ (128,834 U.S. gal.)

Total number of ballast tanks on ship – 10

Total Fuel Capacity:

228,642 U.S. gal. at 98% capacity

Total number of fuel tanks on ship – 15

Other fuel/chemicals to be carried on board and amounts: gasoline – as much as 700 U.S. gal.; lube oil – as much as 10,442 U.S. gal.; numerous other industrial and household chemicals used to operate a 224-foot research vessel

Number of tenders/skiffs aboard and specific type of motors:

Ship's own tenders - 1 each 10 m AMBAR Marine jet boat with Yanmar 370-hp, Diesel inboard engine
 1 each 8 m AMBAR Marine jet boat with Yanmar 315-hp, Diesel inboard engine
 2 each 17.5 ft Zodiac inflatable boats, each with one Honda 50-hp, 4-stroke, outboard gasoline engine
 1 each 19 ft AMBAR Marine rescue boat with Honda 115-hp, 4-stroke, outboard gasoline engine

Does the vessel have the capability to hold sewage and grey-water? Describe in detail. The ship has a 4,000 U.S. gal Collection Holding Tank for sewage and grey water. In those waters where effluent may NOT be discharged, sewage and grey water are held in this tank until the ship is in waters where sewage and grey water may be discharged. The ship has a U.S. Coast Guard-approved Marine Sanitation Device (Omnipure model MSD 12 MC) which is used to treat sewage and grey water in those waters where effluent may be discharged.

Does the vessel have a night-time light protocol for use in the NWHI? Describe in detail. Navigation lights are on 24-hours/day. Work lights are put on at night only when conducting CTD operations. Weather decks are not illuminated at night.

On what workboats (tenders) will personnel, gear and materials be transported within the State Marine Refuge?

Personnel, gear and materials may be transported within the State Marine Refuge by the ship or any of the 5 ship's small boats listed above or by the program-provided small boat listed above.

How will personnel, gear and materials be transported between ship and shore?

Personnel, gear and materials may be transported between ship and shore by any of the 5 ship's small boats listed above or by the program-provided small boat listed above.

If applicable, how will personnel be transported between islands within any one atoll?

Personnel may be transported between islands within any one atoll by any of the 5 ship's small boats listed above or by the program-provided small boat listed above.

**CURRICULUM VITAE
CARL GUSTAV MEYER**

Hawaii Institute of Marine Biology • PO Box 1346 • Kaneohe HI 97644
Tel: 808-236-7477 • Fax: 808-236-7443 • Email: carlm@hawaii.edu

TITLES

Assistant Researcher, Hawaii Institute of Marine Biology, University of Hawaii.

EDUCATION

Ph.D. (Zoology), University of Hawaii at Manoa. "Evaluating the effectiveness of small marine reserves. Waikiki Marine Life Conservation District as a case study.", 2003.
Advisor: Dr. Kim Holland.

M.Phil. (Biological Sciences), University of Plymouth, England. "Biology and fishery of the spider crab, *Maja squinado*, around Jersey (Channel Islands)", 1993.
Advisor: Dr. Malcom Jones.

B.Sc. Hons. (Biological Sciences), University of Plymouth, England, 1990.
Advisor: Dr. Peter Reay.

GRANTS AND AWARDS

2005-2006 NOAA General Coral Reef Conservation Grant: Acoustic monitoring of long-term movement patterns, habitat use and site fidelity of coral reef fishes: Implications for Marine Protected Area design (P.I.: \$28,750).

2005-2006 Hawaii Sea Grant Program: Foraging ecology and movement patterns of blacktip reef sharks at Palmyra atoll (P.I.: \$9,975).

2001 University of Hawaii, **26th Annual Albert L. Tester Memorial Symposium**, Best Student Paper Award.

RESEARCH EXPERIENCE

Assistant Researcher. *University of Hawaii, Joint Institute for Marine and Atmospheric Research.* August 2003 – Present.

- 2005 Ultrasonic tagging study of marine apex predator movements in the Northwest Hawaiian Islands.
- 2003-2005 Experimental investigation of the shark compass sense.
- 2003-2005 Research and development of new electronic telemetry tags.
- 2003-2005 Ultrasonic tagging study of tiger shark movements in Hawaii.

Collaborator. *Hawaii Division of Aquatic Resources Ulua Tracking Project.* 2003-2004.

- Acoustic monitoring study of jack (Carangidae) movements in West Hawaii.

Research Assistant. *University of Hawaii, Hawaii Institute of Marine Biology.* 1993-2003.

- 2001- 2003 Quantified human activities and impacts in four Hawaii Marine Protected Areas using a novel Geographic Information System (GIS) approach.
- 1997-2001 Conducted underwater visual censuses of reef fish populations in and around Waikiki marine reserve.
- 1999-2001 Quantified fishing and other marine recreational activities along the Kewalo-Waikiki-Diamond Head shoreline (south coast of Oahu, Hawaii).
- 1997-2001 Quantified movement patterns, home range sizes, habitat use and dispersal of reef fishes in Waikiki Marine Life Conservation District (a no-fishing marine reserve) using ultrasonic and conventional identification tags.
- 1993-2001 Assisted with shark long lining, tagging and ultrasonic tracking around the Main Hawaiian Islands.
- 1995-1996 Collected gonads and otoliths from commercially targeted coral reef fishes around Oahu.
- 1993-1996 Assisted with reef fish tagging and tracking around Coconut Island (Kaneohe Bay, Oahu).
- 1993-1995 Collected diet data from jacks captured during three annual recreational fishing tournaments designed to gather scientific data.

Collaborator. *French Frigate Shoals Tiger Shark Research Project.* 1999-2003.

- Participated in acoustic monitoring study of tiger shark behavior at French Frigate Shoals Atoll.

Fisheries Biologist. *Department of Agriculture and Fisheries, Jersey (Channel Islands).* 1990 – 1993.

- 1992-1993 Assisted with design and implementation of fishing licensing scheme for local fishing fleet. Carried out survey of commercial and recreational fishing activities.
- 1992 Organized First International Majid Crab Conference.
- 1990-1993 Mapped nursery areas and elucidated juvenile life history of spider crabs (*Maja squinado*).
- 1991-1993 Experimentally tested size selectivity and discard damage rates of spider crab tangle nets.

- 1990-1993 Quantified catch and effort in the commercial spider crab fishery, and participated in spider crab stock assessment cruise.
- 1992-1993 Compared effectiveness of different methods of measuring minimum legal size (MLS) of European lobsters (*Homarus gammarus*).

Undergraduate honors project – University of Plymouth, England

- 1988-1989 Quantified vertical distribution and habitat preferences of intertidal fishes in Jersey (Channel Islands).

PUBLICATIONS

1. Peer Reviewed

- Lowe C.G., B.M. Wetherbee and **C.G. Meyer**. Accepted. Using acoustic telemetry monitoring techniques to quantify movement patterns and site fidelity of sharks and giant trevally around French Frigate Shoals and Midway Atoll. *Atoll Research Bulletin*
- Meyer, C.G.** and K.N. Holland. 2005. The role of movement patterns, home range size and site fidelity in greater abundance and size of bluespine unicornfish (*Naso unicornis*; Acanthuridae) in a small marine reserve. *Environmental Biology of Fishes* 134 (3): 602-606.
- Meyer, C.G.** & R Honebrink. 2005. Retention of surgically implanted transmitters by bluefin trevally (*Caranx melampygus*). Implications for long-term movement studies. *Transactions of the American Fisheries Society* 134: 602-606.
- Meyer, C.G.**, Holland, K.N. & Y.P. Papastamatiou. 2005. Sharks can detect changes in the geomagnetic field. *Journal of the Royal Society Interface* 2: 129–130.
- Wetherbee, B.M., K.N. Holland, **C.G. Meyer** and C.G. Lowe. 2004. Use of a marine reserve in Hawaii by the giant trevally, *Caranx ignobilis*. *Fisheries Research* 67:253-263.
- Meyer, C.G.** and K.N. Holland. 2001. A kayak method for tracking fish in very shallow water. *Reviews in Fish Biology and Fisheries*. In: J.R. Sibert and J. Nielsen (Eds.), Electronic Tagging and Tracking in Marine Fisheries (pp. 289-296). Kluwer Academic Publishers, The Netherlands.
- Holland, K., A. Bush, **C. Meyer**, S. Kajiura, B. Wetherbee, and C. Lowe. 2001. Five tags applied to a single species in a single location: The tiger shark experience. *Reviews in Fish Biology and Fisheries*. In: J.R. Sibert and J. Nielsen (Eds.), Electronic Tagging and Tracking in Marine Fisheries (pp. 237-248). Kluwer Academic Publishers, The Netherlands.

Meyer, C.G., K.N. Holland, B.M. Wetherbee, and C.G. Lowe. 2001. Diet, resource partitioning and gear vulnerability of Hawaiian jacks captured in fishing tournaments. *Fisheries Research* 53:105-113.

Meyer, C.G., K.N. Holland, B.M. Wetherbee, and C.G. Lowe. 2000. Movement patterns, habitat utilization, home range size and site fidelity of whitesaddle goatfish (*Parupeneus porphyreus*) in a marine reserve. *Environmental Biology of Fishes* 59: 235-242.

Holland, K.N., B.M. Wetherbee, C.G. Lowe and **C.G. Meyer.** 1999. Movements of tiger sharks (*Galeocerdo cuvier*) in coastal Hawaiian waters. *Marine Biology* 134: 665-675.

2. Technical Reports

Holland, K.N. and **C.G. Meyer.** 2003. Human Activities in Marine Protected Areas - Impact on Substrates. Final Report. Honolulu, HI: Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawaii, 37 pp

Holland, K.N. and **C.G. Meyer.** 2002. Hawaii Marine Protected Areas Usage Survey – Final Report. Honolulu, HI: Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawaii, 20 pp

Holland, K.N. and **C.G. Meyer.** 2002. Fishing Activity and its Impact on the Efficacy of Marine Protected Areas. Final Report. Hawaii Coral Reef Initiative, 8pp

Meyer, C.G. and S. M. Clark. 2000. A preliminary analysis of human activity patterns in the Waikiki Fisheries Management Area and Marine Life Conservation District. Final Report. Honolulu, HI: Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawaii, 20 pp

Meyer, C.G. and K.N. Holland. 1996. Harvest refugia as fisheries management tools: empirical data on fish movement patterns, habitat use and dispersal. Proceedings of the Western Association of Fish and Wildlife Agencies 76: 200-207.

Meyer, C.G. 1992. Seasonal variation in composition of trap catches of the spider crab (*Maja squinado*, Herbst, 1788) in a known inshore nursery area on the south coast of Jersey (British Channel Islands). International Council for the Exploration of the Sea, Copenhagen (Denmark). Shellfish Committee Meeting Papers. 10 pp.

Bossy, S.F., Le Blancq, D.J. and **Meyer, C.G.** 1992. A comparison between the use of total length and carapace length for measuring the minimum legal landing size for the European lobster (*Homarus gammarus* L.). International Council for the Exploration of the Sea, Copenhagen (Denmark). Shellfish Committee Meeting Papers. 3 pp.

3. Book Chapters

Meyer, C.G. 2001. A day in the life of a marine biologist. pp 18-19 In: Ocean Watch. Dorling Kindersly Publishing Inc., New York, NY.

Holland, K.N., C.G. Lowe, B.M. Wetherbee, A.C. Bush and **C.G. Meyer**. 1998. Sharks and people. pp. 124-153 In: Sharks. Reader's Digest Association, Pleasantville, NY.

REVIEWER

Aquatic Living Resources
California Sea Grant
Caribbean Journal of Science
Environmental Biology of Fishes
Fisheries Research
Hawaii Academy of Science
Journal of Fish Biology
Journal of Shellfish Research
Marine and Freshwater Research
Marine Biology
Marine Ecology Progress Series
National Science Foundation

INVITED PRESENTATIONS

2005 *Using GIS to Assess Marine Reserve Effectiveness*, California State University at Long Beach.

2004 *Evaluating the Effectiveness of Small Marine Reserves*, Leeward Community College, Hawaii.

2004 *Shark movement patterns in the Hawaiian Islands*, Hawaii Sharks Teachers Conference, Hawaii Institute of Marine Biology.

2003 *Reef Fish Movements & Habitat Use*, Hawaii Coral Reef Fishery Management Workshop.

2001 *Tiger shark research in Hawaii*, Hawaii Annual Ocean Safety Conference.

2001 *Why we need marine reserves*, Malama Ohana, Hawaii.

2001 *Reef Fish Migrations*, Waikiki Aquarium, 2001

ADVISORY POSITIONS

Scientific Advisor - Pupukea Marine Life Conservation District task force, 2001-2002.

Participant - Hawaii Marine Protected Area working group, 2002-2003.

APPENDIX 1

**State of Hawai'i
DLNR
Northwestern Hawaiian Islands State Marine
Refuge
Permit Application Form**

<i>For Office Use Only</i>
Permit No:
Expiration date:
Date Appl. Received:
Appl. Fee received:
NWHI Permit Review Committee date:
Board Hearing date:
Post to web date:

Type of Permit

- ☒ I am applying for a **Research, Monitoring & Education** permit. (Complete and mail Application)
- ☒ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a permit for a **Native Hawaiian** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a **Special Activity** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.

Briefly describe **Special permit** activity:

When will the NWHI activity take place?

- ☐ **Summer** (May-July of _____ (year))
Note: Permit request must be received before February 1st
Specific dates of expedition _____

- ☒ **Fall** (August-November) of 2006 (year)
Note: Permit request must be received before May 1st
Specific dates of expedition Aug. 25th-Sept. 28th, 2006

- ☐ **Other**

NOTE: INCOMPLETE APPLICATIONS WILL NOT BE ACCEPTED

Please Send Permit Applications to:

NWHI State Marine Refuge Permit Coordinator
State of Hawai'i
Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai'i 96813

NWHI State Marine Refuge Permit Application
See Appendix 2 for Application Instructions

Section A – Applicant Information	
1. Project Leader (attach Project Leader's CV or resume) <input checked="" type="checkbox"/> CV attached Murakawa, Paul Y. Name: Last, First, Middle Initial	Aquatic Biologist Title
2. Mailing Address (Street/PO Box, City, State, Zip) 1151 Punchbowl Street Room 330 Honolulu, HI 96813	Telephone (808)587-5404 Fax (808)587-0115 Email Address paul.y.murakawa@hawaii.gov
3. Affiliation (Institution/Agency/Organization) Division of Aquatic Resources	For graduate students, Major Professor 's Name & Telephone
4. Sub-Permittee/Assistant Names, Affiliations, and Contact Information <input type="checkbox"/> CV or resume attached Jason Leonard, Division of Aquatic Resources, 832-5007 John Mitchell, Division of Aquatic Resources, 808-243-5835	
5. Project Title DAR ulua tagging project	
6. Applicant Signature Paul Y. Murakawa	7. Date (mm/dd/yyyy) 7/25/2006

Section B: Project Information
8. (a) Project Location <input checked="" type="checkbox"/> NWHI State Marine Refuge (0-3 miles) waters surrounding: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Nihoa Island <input checked="" type="checkbox"/> Necker Island (Mokumanamana) <input checked="" type="checkbox"/> French Frigate Shoals <input checked="" type="checkbox"/> Laysan <input checked="" type="checkbox"/> Maro <input checked="" type="checkbox"/> Gardner Pinnacles <input checked="" type="checkbox"/> Lisianski Island, Neva Shoal <input checked="" type="checkbox"/> Pearl and Hermes Atoll <input checked="" type="checkbox"/> Kure Atoll, State Wildlife Refuge <input type="checkbox"/> Other NWHI location </div> Describe project location (include names, GPS coordinates, habitats, depths and attach maps, etc. as appropriate). We will be conducting our fishing effort when the NOAA vessel, Hiialakai, is at anchor in the evenings.

(b) check all actions to be authorized:

- ☒ Enter the NWHI Marine Refuge waters
- ☐ Take (harvest) ☐ Possess ☐ Transport (☐ Inter-island ☐ Out-of-state)
- ☒ Catch ☐ Kill ☐ Disturb ☐ Observe
- ☐ Anchor ☐ Land (go ashore) ☐ Archaeological research
- ☐ Interactions with Sea Turtles or Monk Seals ☐ Interactions with Seabirds
- ☐ Interactions with Live Coral, Ark Shells or Pearl Oysters
- ☒ Interactions with Jacks, Grouper or Sharks
- ☐ Conduct Native Hawaiian religious and/or cultural activities
- ☒ Other activities Catch, tag, fin clip, and release all fish (ulua)

(c) Collection of specimens – collecting activities (would apply to any activity):

Organisms or objects (List of species, if applicable, add additional sheets if necessary):

Common name	Scientific name	No. & size of specimens	Collection Location(s)
Giant trevally	Caranx ignobilis	Total of 100 of both species	Various locations, where Hiialakai is anchored
Blue trevally	Caranx melampygus		

(d) What will be done with the specimens after the project has ended?

Specimens will be tagged, fin clipped, and released. Fin clips will be sent to lab for DNA analysis.

(e) Will the organisms be kept alive after collection? ☐ yes ☐ no All fish (ulua) will be released

- Specific site/location _____
- Is it an open or closed system? ☐ open ☐ closed
- Is there an outfall? ☐ yes ☐ no
- Will these organisms be housed with other organisms? If so, what are the other organisms?

(Please attach additional documentation as needed to complete the questions listed below)

9. Purpose/Need/Scope:

- State purpose of proposed activities:

The purpose of this project is to help determine the migration patterns and genetic signature of jacks, specifically the giant and blue trevallies in the Northwestern Hawaiian Islands.

Describe how your proposed activities will help provide information or resources to fulfill the State Marine Refuge purpose and to reach the Refuge goals and objectives.

Data could determine if the population of jacks in the Northwestern Hawaiian Islands are unique genetically and determine migration patterns which may be useful for management in the Refuge.

- Give reasons why this activity must take place in the NWHI and cannot take place in the Main Hawaiian Islands, or elsewhere.

For the reasons stated above.

- Describe context of this activity, include history of the science for these questions and background.

It is uncertain that the jacks in the NWHI are different genetically from those in the MHI or if they migrate the vast distance between the NWHI and the MHI. DNA analysis and external dart tags may help DAR determine if either case is true.

- Explain the need for this activity and how it will help to enhance survival or recovery of refuge wildlife and habitats.

To determine genetic makeup and migration pattern of jacks. If they are unique they may be managed differently than in the MHI.

- Describe how your proposed project can help to better manage the State Marine Refuge.

A different management style may be used if the population of jacks in the NWHI is determined to be different than the MHI.

10. Procedures (include equipment/materials)

Fish will be caught with handlines. Brought aboard the vessel, where it will be tagged with a external dart tag, a small portion (the size of a hole punch) of the soft dorsal will be clipped off and preserved in ethyl alcohol. Fish will be measured (fork length) and then released. Handlines, tagging kit, dissecting kit, specimen vials and ethyl alcohol.

11. Funding sources (attach copies budget & funding sources).

NA

12. List all literature cited in this application as well as all other publications relevant to the proposed project.

NA

13. What types of insurance do you have in place? (attach documentation) NA

- ☐ Wreck Removal
☐ Pollution

14. What certifications/inspections do you have scheduled for your vessel? (attach documentation) NA

- ☐ Rat free ☐ tender vessel ☐ gear/equipment
☐ Hull inspection ☐ ballast water

15. Other permits (list and attach documentation of all other required Federal or State permits).

USFWS permit and a NWHI monument permit

16. Project's relationship to other research projects within the NWHI State Marine Refuge, National Wildlife Refuge, NWHI Coral Reef Ecosystem Reserve, or elsewhere.

Currently, the DAR ulua tagging project is active mostly in the Main Hawaiian Islands, with a few fish tagged in the NWHI by commercial fishermen and a few years ago by recreational fishermen on Midway.

Section C: Logistics

17. Time Frame:

Project Start Date

August 25, 2006

Project Completion Date

September 28, 2006

Dates actively inside the State Marine Refuge.

Same as above

Personnel schedule in the State Marine Refuge (describe who will be where and when).

Paul Murakawa, Jason Leonard, and John Mitchell will be in the Refuge for the duration of the timeframe.

18. Gear and Materials

☐ Dive equipment

☐ Radio Isotopes

☒ Collecting Equipment

☐ Chemicals (specify types)

Fishing handlines, tagging kit, dissecting kit, specimen vials and ethyl alcohol.

19. Fixed installations and instrumentation. NA

☐ Transect markers

☐ Acoustic receivers

☐ Other (specify)

20. Provide a time line for sample analysis, data analysis, write-up and publication of information.

Timeline is unknown due to the fact that a fixed amount of samples must be obtained from both the NWHI and the MHI to conduct a genetic comparison of the jacks.

21. Vessel Information:

Vessel Name Hiialakai

IMO Number _____

Vessel Owner NOAA

Flag USA

Captain's Name _____

Chief Scientist or Project Leader Dr. Peter Vroom

Vessel Type Research

Call sign _____

Length 185 feet

Gross tonnage _____

Port of Embarkation Honolulu

Last port vessel will have been at prior to this embarkation Honolulu

Total Ballast Water Capacity: Volume _____ m³ Total number of tanks on ship _____

Total Fuel Capacity: _____ Total number of fuel tanks on ship _____

Other fuel/chemicals to be carried on board and amounts:

Unknown

Number of tenders/skiffs aboard and specific type of motors:

Unknown

Does the vessel have the capability to hold sewage and grey-water? Describe in detail.

Yes. Will be pumping sewage 50 miles from any shore in the evening every other night.

Does the vessel have a night-time light protocol for use in the NWHI? Describe in detail (attach additional pages as necessary)

Unknown

On what workboats (tenders) will personnel, gear and materials be transported within the State Marine Refuge?

None

How will personnel, gear and materials be transported between ship and shore?

NA

If applicable, how will personnel be transported between islands within any one atoll?

NA

CURRICULUM VITAE

Paul Y. Murakawa

Division of Aquatic Resources, Department of Land & Natural Resources
1151 Punchbowl Street Room 330 Honolulu, Hawaii 96813
(808) 587-5404, Fax (808) 587-0115, paul.y.murakawa@hawaii.gov

EDUCATION:

James B. Castle High School 1983-1986 High School Diploma
Kaneohe, Hawaii 96744

University of Hawaii-Manoa 1986-1990 Bachelor of Arts Degree in Zoology
Honolulu, HI 96822

PROFESSIONAL EXPERIENCE:

2005-PRESENT	DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI AQUATIC BIOLOGIST IV (ARTIFICIAL REEF PROGRAM)
	Coordinate and maintain the State's artificial reef program.
2002-2004	DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI AQUATIC BIOLOGIST III (BALLAST WATER & HULL FOULING)
1991-2002	DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI FISHERY TECHNICIAN
1987-1990	UNIVERSITY OF HAWAII-MANOA HONOLULU, HI LAB TECHNICIAN

ADDITIONAL EXPERIENCE:

2002-PRESENT	ALIEN AQUATIC ORGANISM TASK FORCE HONONLULU, HI
1998-PRESENT	DIVISION OF AQUATIC RESOURCES DIVING CONTROL BOARD
2002-2005	STATE OF HAWAII ALIEN INVASIVE SPECIES MANAGEMENT PLAN COMMITTEE MEMBER
2002-2005	PACIFIC ISLAND REGIONAL PANEL (PLAN DEVELOPMENT GROUP MEMBER)

PUBLICATION:

Ostrowski, Anthony C., Thomas Iwai, Sencia Monahan, Shelly Unger, Dionisio Dagdagan, Paul Murakawa, Amanda Schivell, and Corinna Pigao. (1996). **Nursery Production Technology for Pacific Threadfin (*Polydactylus sexfilis*)**. *Aquaculture* 139:19-29.

PROFESSIONAL MEETINGS/CONFERENCES ATTENDED:

- 4th International Marine Bioinvasion Conference
Presented an update of the State's Management Program for Ballast Water and Hull Fouling Introductions
August 2005
Wellington, New Zealand
- California Land Commission Hull Fouling Conference
May 2005
San Francisco, CA
- 3rd International Marine Bioinvasion Conference
Presentation on State's Management Program for Ballast Water and Hull Fouling Introductions
March 2003
La Jolla, California, Scripps Institute
- National Aquatic Nuisance Species Task Force Meeting
November 2002
Honolulu, Radisson Prince Kuhio Hotel
- Global Invasive Species Programme
October 2002
Honolulu, Bishop Museum
- Coralline Algae Identification Workshop
September 2002
Honolulu, University of Hawaii (St. John's Hall)
- American Fisheries Society-Fisheries Symposium
November 2001
Honolulu, University of Hawaii (Campus Center)
- Hawaii Aquaculture Conference
March 2000 and 2001
Kaneohe, Windward Community College
- Invasive Algae Workshop
October 1999
Honolulu, Waikiki Aquarium
- Hawaii Coral Reef Monitoring Workshop
June 1998
Honolulu, University of Hawaii (East-West Center)

CURRICULUM VITAE

Paul Y. Murakawa

Division of Aquatic Resources, Department of Land & Natural Resources
1151 Punchbowl Street Room 330 Honolulu, Hawaii 96813
(808) 587-5404, Fax (808) 587-0115, paul.y.murakawa@hawaii.gov

EDUCATION:

James B. Castle High School 1983-1986
Kaneohe, Hawaii 96744

High School Diploma

University of Hawaii-Manoa 1986-1990
Honolulu, HI 96822

Bachelor of Arts Degree in Zoology

PROFESSIONAL EXPERIENCE:

2005-PRESENT DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI
AQUATIC BIOLOGIST IV (ARTIFICIAL REEF PROGRAM)

Coordinate and maintain the State's artificial reef program.

2002-2004 DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI
AQUATIC BIOLOGIST III (BALLAST WATER & HULL FOULING)

1991-2002 DEPARTMENT OF LAND & NATURAL RESOURCES HONOLULU, HI
FISHERY TECHNICIAN

1987-1990 UNIVERSITY OF HAWAII-MANOA HONOLULU, HI
LAB TECHNICIAN

ADDITIONAL EXPERIENCE:

2002-PRESENT ALIEN AQUATIC ORGANISM TASK FORCE HONOLULU, HI

1998-PRESENT DIVISION OF AQUATIC RESOURCES DIVING CONTROL BOARD

2002-2005 STATE OF HAWAII ALIEN INVASIVE SPECIES MANAGEMENT
PLAN COMMITTEE MEMBER

2002-2005 PACIFIC ISLAND REGIONAL PANEL
(PLAN DEVELOPMENT GROUP MEMBER)

PUBLICATION:

Ostrowski, Anthony C., Thomas Iwai, Sencia Monahan, Shelly Unger, Dionisio Dagdagan, Paul Murakawa, Amanda Schivell, and Corinna Pigao. (1996). **Nursery Production Technology for Pacific Threadfin** (*Polydactylus sexfilis*). *Aquaculture* 139:19-29.

PROFESSIONAL MEETINGS/CONFERENCES ATTENDED:

- 4th International Marine Bioinvasion Conference
Presented an update of the State's Management Program for Ballast Water and Hull Fouling Introductions
August 2005
Wellington, New Zealand
- California Land Commission Hull Fouling Conference
May 2005
San Francisco, CA
- 3rd International Marine Bioinvasion Conference
Presentation on State's Management Program for Ballast Water and Hull Fouling Introductions
March 2003
La Jolla, California, Scripps Institute
- National Aquatic Nuisance Species Task Force Meeting
November 2002
Honolulu, Radisson Prince Kuhio Hotel
- Global Invasive Species Programme
October 2002
Honolulu, Bishop Museum
- Coralline Algae Identification Workshop
September 2002
Honolulu, University of Hawaii (St. John's Hall)
- American Fisheries Society-Fisheries Symposium
November 2001
Honolulu, University of Hawaii (Campus Center)
- Hawaii Aquaculture Conference
March 2000 and 2001
Kaneohe, Windward Community College
- Invasive Algae Workshop
October 1999
Honolulu, Waikiki Aquarium
- Hawaii Coral Reef Monitoring Workshop
June 1998
Honolulu, University of Hawaii (East-West Center)